



2008 Beam Instrumentation Workshop

May 4–8, 2008

Granlibakken Conference Center

Lake Tahoe, California

FARADAY CUP AWARD

The Faraday Cup Award is intended to recognize and encourage innovative achievements in the field of particle accelerator beam instrumentation. It is donated by Bergoz Instrumentation, of Saint-Genis-Pouilly, France. The award consists of a certificate and \$5000.00 (U.S.). These are presented every other year at the Beam Instrumentation Workshop (BIW), whose Program Committee is solely responsible for the selection of the recipient.

History

The Beam Instrumentation Workshop (BIW) was started to provide a forum for in-depth discussions of techniques for measuring charged-particle beams produced in high-energy accelerators. In the past, the large U.S. and European Particle Accelerator Conferences dedicated only a few sessions to instrumentation, thus making it difficult to have significant interaction among others in the field. It became apparent to Dick Witkover at Brookhaven National Laboratory (BNL) that a conference or workshop dedicated to instrumentation was needed.

After meetings with representatives from the other national labs across the U.S., the first Accelerator Instrumentation Workshop was held at BNL in 1989. During the last day roundtable discussion, the idea for the Faraday Cup Award was born as a means of encouraging young engineers and physicists to become more innovative. Discussions between Bergoz and the Organizing Committee continued through the next Beam Instrumentation Workshop (as it was now called) at Fermi National Accelerator Laboratory in 1990 with a final agreement on how to keep the Award fair and noncommercial reached in 1991. The procedures for selecting the winner were written primarily by Bob Shafer soon after, and they have remained virtually unchanged since then. The clever name of the Award, referring to both a trophy and a measurement device, is attributed to Bob Webber.

Selection Criteria

The Faraday Cup Award is presented to those who have made outstanding contributions to the development of innovative beam diagnostic instruments of proven workability. The prize is only awarded for demonstrated device performance and successful publication of the results.

2008 FARADAY CUP AWARD

This year, the award (in its 10th edition) was assigned to Dr. **Suren Arutunian** of the Yerevan Physics Institute of Armenia for:

*The invention, construction and successful test of the diagnostic system
"A Vibrating Wire Scanner".*



From left to right: Julien Bergoz (Faraday Cup Award sponsor), Suren Arutunian (2008 Faraday Cup Award Recipient), Fernando Sannibale (BIW08 Chair).

Past recipients of the Faraday Cup Award

- 2006 Haixin Huang, BNL, and Kazuyoshi Kurita, Rikkyo University
- 2004 Toshiyuki Mitsuhashi, KEK
- 2002 Andreas Jansson, CERN
- 2000 Kay Wittenburg, DESY
- 1998 Andreas Peters, GSI
- 1996 Walter Barry, LBNL and Hung-chi Lihn, SLAC
- 1994 Edward Rossa, CERN
- 1993 Donald W. Rule & Ralph B. Fiorito, NSWC
- 1992 Alexander V. Feschenko, INR

For more information: www.faraday-cup.com/

A WINNING TRADITION: THE FARADAY CUP AWARD

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The Faraday Cup Award is given for an outstanding contribution to the development of an innovative particle beam diagnostic instrument of proven workability. "Like a 'Nobel Prize' for the beam instrumentation community," is how the 2000 winner, Kay Wittenburg of DESY, describes the Faraday Cup Award. It is presented at the Beam Instrumentation Workshop (BIW), a biennial forum for in-depth discussions of techniques for measuring particle beams produced in accelerators. The Faraday Cup winner receives a US \$5,000 cash prize, \$1,000 for BIW travel expenses, and a certificate of award. An acceptance speech is given at the workshop by the Awardee in the form of a talk on the design and performance of the winning instrument.

Like many other awards, the Faraday Cup Award comes with a storied tradition. The first Beam Instrumentation Workshop was organized by Richard Witkover and held at Brookhaven National Laboratory in 1989 to stimulate interaction among those in the instrumentation field. The idea for an award was conceived during round-table discussions the last day of that meeting as a way to encourage innovation among young engineers and physicists. Agreement on policies for keeping the award fair and non-commercial was reached in 1991 based on nomination and selection procedures written primarily by Bob Shafer. Naming of the award is attributed to Bob Webber. Financial sponsorship of the Faraday Cup Award is donated by Bergoz Instrumentation.

The BIW Program Committee is solely responsible for selecting the Award recipient. The Committee accepts nominations for the award approximately 12 to 18 months in advance of each BIW. Self-nomination is permitted. The award is open to candidates of any nationality for work done at any geographical location. Instrument performance must be proven using a primary charged particle beam; mere concepts or "bench-top" demonstrations are not acceptable. A description of the device, its operation and performance must be published in a journal or conference proceedings that is in the public domain. In the event of deciding between works of similar quality, preference is given to candidates in the early stages of their beam instrumentation career. The award may be shared between persons contributing to the same accomplishment. Complete rules are available at <http://www.faraday-cup.com>.

Since the first Faraday Cup Award in 1992, thirteen people from laboratories around the world have received the Award (see Table 1) and have gone on to continued career success. Although each prize award is a one-time event, the rewards from the prize have continued for the winners.

Table 1: Faraday Cup Award Winners

Edition	Winner	Diagnostics
1992	Alexander V. Feschenko, INR	Longitudinal Bunch Shape Measurement using Wire Probe Secondary Emission
1993	Donald W. Rule & Ralph B. Fiorito, NSWC	Techniques for Measuring Bunch Shapes by OTR
1994	Edward Rossa, CERN	Technique for Measuring the 3-D Bunch Shapes
1996	Walter Barry, LBL and Hung-chi Lihn, SLAC	Sub-ps e ⁻ Bunch Shape Measurement Techniques
1998	Andreas Peters, GSI	Cryogenic Current Comparator
2000	Kay Wittenburg, DESY	Beam Loss Monitor Using PIN Diodes
2002	Andreas Jansson, CERN	Quadrupole Beam Pickup
2004	Toshiyuki Mitsuhashi, KEK	Interferometric Profile Monitor Using Synchrotron Radiation
2006	Haixin Huang, BNL, and Kazuyoshi Kurita, Rikkyo Univ.	Innovative Proton Beam Polarization Monitoring System
2008	Suren Arutunian, YerPhi	Vibrating Wire Sensor for Beam Instrumentation

PhD students can have breakout results and winning instruments have emerged from their thesis work. In 1996, Walter Barry of Lawrence Berkeley National Laboratory and Hung-chi Lihn of the Stanford Linear Accelerator Center shared the Faraday Cup Award for development of techniques to measure the bunch shape of subpicosecond electron beams. Lihn, a PhD student at the time, sees the award as a great recognition, by experts in the field, of his

years of work and ideas. Now in industry, Lihn still calls upon the skills that he developed building his winning instrument. While he did not personally continue with further development of the device, Lihn's thesis and paper have been cited by a number of others and the ideas have been adopted in other labs.

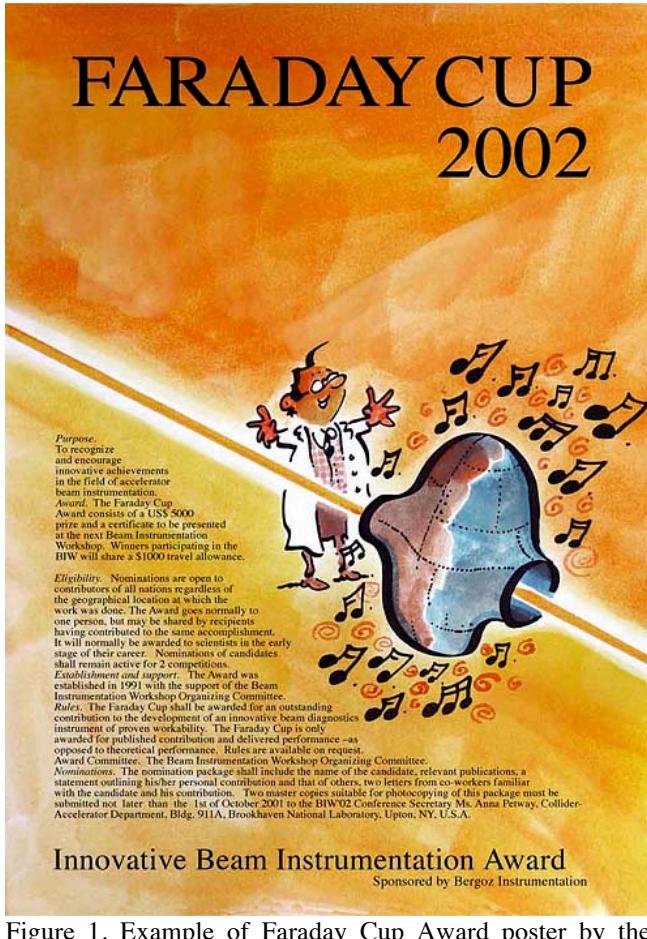


Figure 1. Example of Faraday Cup Award poster by the artist Pecub. More on the Faraday Cup Award web site (<http://www.faraday-cup.com>).

Development of a magnetic quadrupole pick-up began as a simple idea that eventually became a main theme of Andreas Jansson's PhD dissertation. Working many hours at CERN with a network analyzer by his side, Jansson won the 2002 award for his pick-up which measures the quadrupole moment, or ellipticity, of a particle beam. After BIW '02, nearing the end of a CERN postdoc position and looking to widen his horizons, he visited several US laboratories and then accepted a People's Fellowship at Fermi National Accelerator Laboratory, where he continues to work. Jansson credits some of his career success to his Faraday Cup Award win and the resulting visibility that came with it.

Like Lihn, who faced different challenges when moving to an industry position, Jansson had to call on his acquired skills in his new position at FNAL. The pick-up that he had developed for the CERN PS was not optimal for the Tevatron with its dual beams and helical orbits. He started work on other instruments such as Ionization Profile Monitors and Microwave Schottky Monitors. Jansson's fondness for his PhD work is evident as he tries to keep up with the development of various quadrupole detectors by others, including quadrupole mode cavities and electro-optical devices.

In its history, the Faraday Cup Award has recognized a wide range of innovations and advancements in beam diagnostics. The very first winner of the Award, Alexander V. Feschenko of the Institute for Nuclear Research in the Academy of Sciences of Russia, won for a technique to measure the longitudinal bunch shape of a charged hadron beam with picosecond resolution using secondary emission from a fine wire probe. Bunch shape information is used to study beam dynamics and to tune an accelerator.

A device to measure three-dimensional bunch shapes of picosecond e+/e- bunches in a single shot was the winning device for Edward Rossa in 1994. He developed this using a streak camera for the CERN Large Electron Positron collider. Synchrotron radiation emitted by particles creates images of the density distribution; Rossa's optical setup provides front, top, or side views.

Applications based on radiation emitted from charged beams have resulted in several prize-winning devices. In 1993, the first joint award of the Faraday Cup was given to Donald W. Rule and Ralph B. Fiorito for their work at the Naval Surface Warfare Center – White Oak using optical transition radiation (OTR). Together they developed several techniques to measure the divergence and emittance of charged particle beams utilizing OTR produced from thin intercepting foils.

In the years since the award, Rule pursued other fields of research, but has continued contributing to beam instrumentation development in small ways. He states that the recognition of receiving the award was an encouragement to remain actively connected to the beam instrumentation community and has offered great opportunities to meet and collaborate with many interesting and exciting colleagues. Fiorito echoes these statements, indicating that the national and international awareness provided by the award directly resulted in new professional opportunities which he believes would not have otherwise been possible.

Other benefits resulted from this award. At the time of their research, studies of beam physics had just recently been established at their laboratory. The Faraday Cup Award pointed out to the Navy, as well as to the accelerator community at large, that significant new ideas could be generated outside of a traditional accelerator laboratory setting. The award also stimulated a great deal of interest in transition radiation based techniques and gradually more scientists and engineers have implemented these and related techniques at facilities around the world.

The 2000 winner, Kay Wittenburg, triumphed for the design of a beam loss monitoring detector using PIN diodes in a coincidence configuration. His design discriminates between synchrotron radiation present in electron accelerators and radiation due to actual beam loss. The design eventually became commercialized and is now used in accelerators worldwide. DESY granted Bergoz Instrumentation a license to use the original concept of the PIN Photodiode Beam Loss Monitor, to further develop it, and to sell instruments based on this principle. Wittenburg, leader of DESY Machine Diagnostics and Instrumentation since early 2000, believes that the development of a new idea, the overall performance, and the reliable functioning of the system was greatly important to him.

Employing synchrotron radiation for a unique beam profile monitoring system won Toshiyuki Mitsuhashi of KEK (High Energy Accelerator Research Organization, Japan) the Faraday Cup Award in 2004. Mitsuhashi labored on the development of synchrotron radiation (SR) monitors for twelve years before receiving this award, with the development of the SR interferometer being the most significant topic. He conceived the idea in 1994 while investigating the coherence of SR and determined that he would be able to use the SR interferometer for measurement of beam profile and size.

The Faraday Cup has honored “bright” ideas based on synchrotron light, along with some “cool” ideas as well. Andreas Peters of GSI won the 1998 award for his work on the Cryogenic Current Comparator (CCC). This device measures nanoampere DC beam current by comparing it to a known current as both are passed through a cryogenic cylinder. Since Peters’ development, several groups have worked on the CCC, especially in Japan where a CCC was built at TARN-II. CCC projects are now underway at DESY and again at GSI for the FAIR project. Peters declares that the “Faraday Cup Award was a great honor and a gratification for some years of hard, but exciting, work on the CCC project at GSI.” He became the beam diagnostics group leader at GSI in 2000, and believes winning the award was the “kick” to this new position. At the end of 2006, Peters became head of the accelerator

operations for the Heidelberg Ion Therapy project, a heavy ion cancer treatment facility of the Heidelberg University Clinics, and he still works on special beam diagnostics topics.

A joint award was given in 2006 to Haixin Huang of BNL and Kazuyoshi Kurita of Rikkyo University for an innovative proton beam polarization monitoring system. Their design uses ultra-thin carbon filaments and an array of silicon detectors to deduce the degree of polarization from proton-carbon elastic scattering. Huang calls the award a great milestone in his career and welcomes the recognition of his and Kurita’s contribution to the device. In the two years since the award, the CNI polarimeters at BNL have been upgraded, most notably with a new target drive assembly for more precise target control. Kurita is now in charge of implementing the CNI polarimeter for polarized proton projects at the new 50 GeV J-PARC accelerator currently under construction in Japan.

Clearly, the Faraday Cup award has been a career highlight for past winners. They all overwhelmingly acknowledge and appreciate the recognition from experts in the field and from collaborators alike. Their stories prove that innovation can come from anywhere – a student or a professional, a government accelerator facility, university, or other lab, and any geographic location.

The BIW Program Committee is eager to receive nominations for devices that are pioneering and provide new insight into particle beam measurements. If you or a colleague has developed any instrument that meets the award criteria, please nominate it for the competition at the next Faraday Cup Award.

Author’s Note: The author would like to thank Bob Webber and the BIW Program Committee for their support and ideas. Many thanks also go to the past recipients of the Faraday Cup Award for graciously sharing their insights. References for papers written about each of the winning devices can be found at www.faraday-cup.com.